August 21, 1997

National Beef Science Seminar

SUMMARY OF PROCEEDINGS

Building Canada's Beef Industry

The research summary report you're reading is part of a new effort by the Lethbridge Research Centre to get research results to the beef community.

As a research group we have worked closely with the cattle industry nationally for many years. As the Centre recently designated as national headquarters for beef production efficiency research for Agriculture and Agri-Food Canada's beef research program, our target is to aggressively serve Canada's beef industry long-term.

Technology transfer - getting technology and knowledge out to industry - has always been part of our mandate, but today we're approaching that role more aggressively.

The National Beef Science Seminar is designed to focus on the value of science to the cattle industry, and to provide a window on some of the key research at the Lethbridge Research Centre. We've worked with the industry sponsors listed on the back page of this publication to design a seminar specifically for beef feedlot owners and managers. It is designed as a relaxed learning atmosphere, so that producers, extension and researchers can see first-hand our facilities, meet scientists and learn about the programs in place.

But our mandate is Canada-wide, and not everyone can attend the Lethbridge seminar. We want to ensure that any beef or dairy producer, or anyone else involved with the cattle industry who wants information on our research can get it.

For starters, we will provide a copy of this National Beef Science Seminar ***Summary of Proceedings*** free of charge. For those people who want more in-depth information, we have produced LRC ***Research Reports*** on many of the presentations at the National Beef Science Seminar. Copies of these ***Research Reports*** are available by contacting the researcher personally, or the Livestock Sciences Section of the Lethbridge Research Centre at the address on the back of this publication.

You'll also see more information in the media throughout the coming year. We have dramatically increased the amount of information we provide to industry. And we have some even more innovative approaches planned for the coming months.

If you would like to receive additional information contact the Lethbridge Research Centre, and leave your name, address, phone, fax or E-mail address. We welcome your comments, questions or suggestions at any time.

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Agriculture and Agri-Food Canada Research Branch

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New alternative forage sources for cattle

Two forages new to North America could soon be valuable alternatives to conventional crops. Studies show that perennial rye has many advantages over barley as a silage crop and fenugreek is a viable alfalfa alternative.

Perennial rye. This forage produces a silage crop that matures a few weeks earlier than barley, but has almost identical yields and nutritional quality. The crop persists for several years, takes advantage of spring moisture and has good regrowth for a second cut of hay or pasture.

Despite those encouraging characteristics, perennial rye has some hurdles to cross. Because the crop is a hybrid of two distinct species, it produces many sterile flowers. Less than 50 percent of the florets produce seed in this open pollinated crop. It also has an extended flowering period that makes the crop vulnerable to seed-borne diseases such as ergot and smut.

Scientists are working to reduce the sterility level using traditional and haploid breeding techniques. Studies are underway to determine the best conditions for maximizing forage and seed yield. Despite the hurdles, the crop shows great potential as an economical and sustainable alternative to barley silage.

Fenugreek. This crop is new to Canada, but has been grown in India and other countries for its seed, which is used as a condiment. Scientists here have recently discovered its potential as a valuable forage alternative.

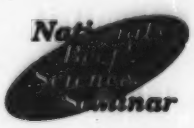
Fenugreek is an annual that holds its high protein. Perennial rye takes advantage of spring moisture and has good regrowth.

The high-protein legume makes good silage and is a natural source of valuable steroids that may increase muscle development. Like alfalfa, it's a high-quality legume that fixes nitrogen in the soil. But while alfalfa is a perennial, fenugreek is an annual crop.

It has slightly less dry matter and protein than alfalfa -16 to 18 percent protein compared with 18 to 20 percent - but is relatively equal in terms of nutritional quality for cattle. A major advantage of fenugreek is that, unlike alfalfa, its quality holds constant after blooming, giving producers more flexibility for harvest. Preliminary experiments also suggest fenugreek may be bloat-safe.

The high cost of seed and lack of weed control measures are obstacles to overcome before the new forage is widely used. But its high, sustainable quality makes fenugreek a viable alternative to alfalfa. Researchers know cattle will eat the forage and do well on it. Further study will explore its potential for optimal beef production.

For a Research Report contact Dr. Surya Acharyya, (403) 317-2277.



Get a grip on pest control in feedlot cattle

Pest control in the future will have more options, less chemical use and more strategic planning, say scientists at the Lethbridge Research Centre. By integrating biological controls with conventional protection products and waste management strategies, they're helping producers win the battle with pests.

More options, better strategies will bolster livestock protection in the future.

The pest complex associated with western Canadian feedlots can be separated into flies (summer) and lice, grubs and mange (winter).

Protecting cattle from lice

The most serious of winter pests in the feedlot are blood feeding and chewing lice. Though they can potentially cause significant economic losses, research results show lice can be effectively controlled with chemical treatments. By following a few simple guidelines, most lice control failures can be avoided:

- Remember: lice infestations are spread by contact, so untreated cattle should not be mixed with treated cattle.
- Some products do not have residual activity that is long enough to kill newly hatched young that appear up to ten days after the adults have been killed.
- Always check the manufacturers recommendations regarding the need for a second treatment to kill these newly hatched lice.

Stopping flies

The most economically important fly species is the stable fly, which feeds on cattle blood. But flies are not just a problem on the feedlot. Many complaints arise when nuisance species such as house flies move from feedlots into neighboring urban areas. The broad impact of flies requires a wide range of control. Scientists at the Lethbridge Research Centre are using a multi-faceted attack:

Conventional control. Application of residual insecticide sprays can be a useful addition to a fly management program. Good targets for spraying are shady, vertical surfaces around the feedlot where flies like to rest at night after their blood meals. However, they require applications every 2-3 weeks and can be time consuming if the feedlot is large. Treatments applied to the cattle - pour-ons, sprays, dustbags or insecticide impregnated ear tags - are not as effective because the insecticides do not sufficiently reach the legs where the flies prefer to feed.

Biological control. Research is underway to evaluate the use of parasitic wasps in stable fly management programs. Some wasps are already available for biocontrol, but the Lethbridge Research Centre program is directed at native strains or adapted for western Canada's climate. These wasps search out fly pupae and deposit eggs which produce larvae capable of killing flies as they develop inside the pupa. When the research is complete these wasps will be used in mass releases at feedlots to augment the sanitation program and judicious use of residual sprays.

Cultural control. A key element in managing stable flies is sanitation. Removal or reduction of sites where maggots can develop will greatly reduce fly populations. Thorough and regular cleaning around the feedbunks, aprons and around the edges of bunker or pit silos is essential. Even small areas can produce significant fly numbers. The use of other controls is dramatically weakened if a sanitation program is not in place.

For a Research Report contact Dr. Doug Colwell, (403) 317-2254.

Get more mileage from grain in cattle

Maximizing grain availability in the rumen while supplying enough fiber to prevent acidosis is the key to improving cattle rations, say researchers. But how can producers determine those precise targets?

A recent study at the Lethbridge Research Centre has eliminated some of the guesswork. Here's a summary of the findings and recommendations:

Grain processing. The study found that adding 12 percent water to barley for a total moisture content of 21 percent and letting it sit for 16 hours before rolling resulted in optimum ruminal digestion. This temper rolling process has an advantage over dry rolling because there are no fines to increase the chances of sub-clinical acidosis and liver abscess.

Though barley must be processed to ease digestion, extremely rapid digestion can cause dramatic swings in rumen acidity. The researchers recommend processing barley until it reaches 80 to 85 percent of its original density. For example, a barley with a bushel weight of 46 pounds should be rolled until it reaches 36.8 to 39.1 pounds. This guideline can be modified according to grain prices.

When prices are low, grain processing should be minimized to reduce the chance of sub-clinical acidosis. Conversely, when prices are high, processing should increase to maximize grain digestion. In that case, fiber must be supplied to balance the rapid production of acids in the rumen at higher rates of grain digestion.

Fiber must be supplied to counter the rapid production of acids in the rumen at higher rates of grain digestion. Optimum balance is key.

In a survey of 10 Alberta feedmills, researchers found that the change in density for steam-rolled barley was 68.7 percent, with a range of 63.1 to 78.9 percent. Those levels from commercial mills are necessary to ensure maximum digestibility, but they also boost digestion rates within the rumen. By contrast, a survey of nine Alberta feedlots shows the average change in density was 79.8 percent, with a range of 71.6 to 90.9 percent. The feedlots used either temper-rolled or dry-rolled barley.

Effective fiber. Feeding 10 percent barley silage in feedlot diets was the optimum level in the study, but that amount should be adjusted depending on the chop length and extent of processing. A low concentration of silage increases weight gain up to a certain point by enhancing the rumen function, but too much silage decreases weight gain by lowering the energy intake.

Samples of barley silage from various southern Alberta feedlots showed wide variance in actual mean particle length - 1/4 to 1/2 inch - despite having the same theoretical harvest lengths of 3/8 inch. The variance makes it clear that silage amounts need to be adjusted according to particle length. Coarsely-processed grain will stimulate greater rumination than finely-processed grain, regardless of the silage amount. Thus, when silage particle length is fine, more silage should be fed to supply the same amount of effective fiber.

For a *Research Report* contact Dr. Karen Beauchemin, (403) 317-2235.

Enzymes could change beef production

Ground-breaking enzyme technology for low-cost feed has potential to revolutionize beef production. By defining where enzymes operate, matching them to feed and optimizing their application, scientists are taking steps to solve the enzyme puzzle and bring direct benefits to the livestock industry.

Researchers believe enzymes will boost cattle digestion, increasing nutrient utilization from conventional feed and nutritional value from low-cost feed alternatives. Here's an overview of the research direction:

The catalysts. Enzymes are proteins that catalyze chemical reactions in all biological systems. Part of this function is breaking down feeds into their chemical components. Researchers believe using them effectively will improve cattle digestion.

The action. Specific enzymes with various strengths and functions are needed to break down feed. It takes literally hundreds of enzymes to complete digestion of complex feeds such as alfalfa hay or barley grain. They do so by degrading the array of chemical bonds within the complex, interwoven matrix of polymers in the plant cell wall.

Enzymes are proteins that catalyze chemical reactions in all biological systems. Researchers believe using them effectively will improve feed digestion.

Commercial enzyme products marketed as feed supplements are fermented extracts of bacterial or fungal origin. The complex mixtures are marketed on their ability to digest the chemical components of plant cell walls, but many possess activity against other substrates such as starch and protein. Differences in enzyme types and concentrations in the preparations produce widely varying effects.

The challenge. Researchers hope to match enzyme preparations with specific feeds, but the magnitude of enzyme processes makes engineering production strategies a painstaking process. Identifying which enzymes can improve forage digestion is a major hurdle to overcome. The rumen already contains an extensive array of microbial fibrolytic enzymes that play an important role in digestion, and it's unclear at this point whether treatment of forages with fibrolytic enzymes can further improve utilization of the feed in an economical manner.

The bottom line. Research shows that enzymes have dramatic potential for improving the efficiency of ruminant digestion. However, the technology is at an early stage and the performance of exogenous enzymes on performance has been variable. It's extremely difficult to predict when applying a given enzyme cocktail is likely to have a positive response, but that is expected to improve with further study.

Researchers are moving forward by targeting enzyme preparations toward cleavage of the bonds most likely to limit feed digestion. A first step is defining the site of enzyme action. Once the various sites are defined, scientists can take steps to formulate enzyme preparations that have a constant, positive response over a range of feeding conditions. Matching enzymes to specific feeds will further improve efficiency and result in application strategies to make enzymes an economically viable tool for the future.

For a *Research Report* contact Dr. K-J Cheng, (403) 317-2234.

Waste management: Taking advantage of manure nutrients

Manure is an excellent nutrient source with all the essential elements for growing crops, but too often this valuable resource goes to waste. Scientists believe land application is the best way to use the benefits of manure and make intensive livestock operations more sustainable.

The potential is huge. Studies show that manure from Alberta feedlots alone could provide the total phosphorous requirements for the entire province. But how can producers make the most of this resource? Scientists say a successful strategy starts with determining the economic value of manure nutrients.

An economically-valuable nutrient source. Manure's value is based on it's nitrogen, phosphorous, potassium and micronutrient contents. These contents vary depending on the animal, feeding program and manure handling system, with an estimated value of $10 to $20 per tonne. But a dollar value based solely on chemical analysis is not a true measure. Many other less-quantifiable effects are associated with land application on soil:

Physical properties. Manure increases carbon content and, at appropriate rates, increases soil water-holding capacity by improving aggregation.

Chemical properties. Manure increases the amount of organic matter in soils and affects the availability of nutrients.

Biological properties. Manure contributes to the growth of beneficial soil organisms, but also introduces manure pathogens.

The effects depend on the soil conditions, quality of manure and application rate. If manure could be distributed appropriately, scientists estimate the total potential fertilizer replacement from livestock production would approach $34 million each year in Alberta. However, this estimate doesn't include costs for transportation, processing and management.

Manure effects on crops. Manure can match or beat the value of any commercial fertilizer. The key is developing an effective nutrient strategy that maximizes its value within a given farming operation.

Manure must be applied at a rate dictated by the manure nutrient present at the highest concentrations relative to crop need. Historically, manure has been applied at a rate to fulfill crop nitrogen requirement without causing environmental problems such as nitrate leaching to ground water. This strategy maximizes application rate but makes relatively inefficient use of manure phosphorous and potassium. Relying on manure for supplemental nitrogen in crop production can be a disadvantage because it's hard to predict when the nitrogen becomes available.

In a strategy based on phosphorous availability, manure is applied at a rate meeting the crop's phosphorous requirement. This is the most conservative application strategy because it dictates the lowest application rates, is the least likely to have undesirable side effects, and makes the most efficient use of all manure nutrients. But the method is more expensive than other strategies in terms of labor, energy and time. A more practical alternative might be to apply enough manure to meet crop phosphorous needs for several years and to use nitrogen fertilizer in the intervening years.

For a *Research Report* contact Dr. Chi Chang, (403) 317-2220.

Unlocking the secrets of bunk management

Bunk management. It's a commonly used, yet relatively poorly defined term in the feedlot industry. To some, it simply means keeping manure and stale feed out of bunks. But effective bunk management is much more.

Researchers are using technology to develop systems for optimal bunk management. By learning more about intake regulation and rumen acidosis, they're finding new ways to improve cattle performance.

Manipulating feed delivery to maximize energy intake while minimizing the negative effects of acidosis is what bunk management is all about.

Innovative technology. In cooperation with Pfizer Animal Health, Lethbridge Research Centre scientists are using the GrowSafe system - new technology that monitors individual cattle feeding behavior. The goal is to use data collected by the system to determine the point where optimum feed intake results in minimal feed costs and maximum performance.

GrowSafe gives researchers access to precise information previously unavailable. An antenna in the feed bunk detects electronic ear tags on each animal, allowing a computer to record the time, location and duration of each bunk visit. Scientists also closely monitor feed intakes to determine the relationship between time at the bunk and actual intake.

Fine-tuned feeding systems. Manipulating feed delivery to maximize energy intake while minimizing the negative effects of acidosis is what bunk management is all about. Although acids produced from feeds are a primary source of energy for cattle, feeders know too much can cause harmful acid accumulation in the rumen. That causes inconsistent eating patterns which make the problem worse.

With associated reductions in intakes and performance, and increases in related health problems such as laminitis, rumenitis, liver abscesses and polio, acidosis can be an expensive factor in finishing cattle. It's why nutritionists and veterinarians spend a lot of time on bunk management. But many of the recommendations are based on opinions and intuition. Researchers believe data collected by the GrowSafe system will allow for more precise evaluations and better cattle performance.

Intake fluctuations and the problems associated with over- or under-feeding can also be avoided. By limiting the size and frequency of feed increases, an intake plateau can be established to reduce variation.

For a *Research Report* contact Dr. Tim McAllister, (403) 317-2240.

Controlling atmospheric emissions from feedlots

Reducing ammonia emissions from feedlots is the target of a new research initiative at the Lethbridge Research Centre. By measuring the emissions, determining their impact on crop growth and looking at method of reduction, scientists are working to improve the sustainability of intensive livestock operations.

Odor from animal manure in feedlots, and subsequent land application, is a major concern researchers have looked into in a recent study. Results show that significant control of odor-producing components is possible with relatively simple management practices immediately following manure application.

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The problem. Ammonia is the predominant gas emitted from manure and is a concern because it reduces air quality immediately downwind from a manure source and can form fine aerosols which are transported longer distances.

At high concentrations, ammonia is an irritation to mucous membranes and can cause human health problems. High concentrations found within barns are also linked to reduced weight gains in livestock. Atmospheric ammonia releases are absorbed by soil and water, and contribute to acidification and nitrogen loading of these important resources.

The problem begins in the feedlot but many of the local complaints arise once the manure is spread on land. It is common that as much as 50 percent of the nitrogen found in manure can be lost as ammonia to the atmosphere, reducing the nutrient value of land-applied manure.

The solution. Scientists believe the best solution is for operators to have well-researched strategies available which reduce odor-producing compounds and harmful emissions. As a step toward that goal, they undertook a recent study to develop techniques to monitor ammonia emissions from small plots using acid samplers.

The experiment looked at the impact of post irrigation and tillage on the ammonia emitted from manure-amended soil. Ammonia emissions from the surface applied manure accounted for 19.7 percent of the total nitrogen applied. This was reduced to 9.7 and 4.2 percent with 6 mm of post-application irrigation and post-application tillage, respectively. More than 50 percent of the ammonia emitted occurred within the first 20 hours, showing the huge potential of immediate control.

For a *Research Report* contact Dr. Sean McGinn, (403) 317-2225.

Get the most out of high-yield alfalfa varieties

Lethbridge Research Centre scientists are part of an industry working aggressively to develop high-yielding alfalfa varieties for the future. But while the potential in these new varieties is tremendous, the key to tapping that potential is getting a good stand. Here are five simple steps researchers follow for consistently producing maximum yields:

Seed early. Early spring is best. Growers can be lucky seeding perennial forages at other times, but spring seeding consistently comes out ahead in trial plots.

Seed only forage. If all rules for forage establishment are followed, researchers have found they can get a good stand without the drawbacks of using a nurse crop. The extra forage yields in the establishment year plus the extra in subsequent years, usually increase sufficiently to compensate for initial yield loss from a companion crop.

Seed shallow. Seeding too deep often causes forage seeds to fail, and those that do emerge have widely-staggered emergences. Forage seeds should be planted in a firm, weed-free seedbed no deeper than 12 mm (1/2 inch). Remember, forage seeds have small reserves of nutrients and do not compete well at the early seedling stage.

At the Lethbridge Research Centre, scientists irrigate plot areas three to four days before seeding to firm the seedbed. On dryland, producers should direct-seed or harrow the field to firm the seedbed, then make sure the seed is covered and packed well.

Choose the right variety and species. Anik alfalfa is the top performer in northern Alberta, but at the Lethbridge Research Centre, it yields only five to 10 percent of AC Blue J. This illustrates the importance of choosing species and varieties based on specific conditions and purposes. It's important to remember that forage cultivars can be registered for all of Canada based on trials in just one province, even though those cultivars may produce widely-different results in different areas.

Growers should make a decision based on facts. The best advice is to check provincial recommendations for the area and talk to specialists with direct experience or knowledge on which varieties will thrive under particular conditions.

Seed preparation. Results show that seed treatments have many advantages. Producers seeding alfalfa or cicer milkvetch - both of which have hard seeds that can take up to two years to germinate - should have the seed scarified. But scarified seed shouldn't be stored for more than a few months.

Experience also shows it's important to choose the right inoculant for the crop. Legumes, peas, cicer milkvetch and alfalfa all have specific inoculants that are not interchangeable. Inoculants should be protected from heat and applied no more than a day or two before seeding. Seed coating may help in some cases. Scientists have evidence of better seedling vigor with coated seed, perhaps because of the fertilizer in the coatings. Coated seed is also bigger than natural seed, so plant spacing tends to be better.

Also, mowing down the crop when the seedlings are 25 to 30 cm high helps the perennial crop stool out and cover the ground quickly while reducing competition from annual weeds.

For more information contact Dr. Jim Moyer, (403) 317-2272.

Alternative by-products in feedlot diets

A cheap feed alternative for cattle that doesn't tie up land in forage production may spark renewed interest in the feedlot industry. Work at the Lethbridge Research Centre in collaboration with the University of Saskatchewan and Canbra Foods shows that screenings - the by-products of grain and oilseed cleaning - can be valuable in feedlot diets.

The resource. Coarse screenings are separated from grain and include mainly chaff, other grains, weeds and inseparable seeds or pieces of stem. These are further separated into three levels of screenings with decreasing feed value. The bottom level is refuse screenings.

Though refuse screenings are bulky, light and highly variable in composition, scientists believe they represent a good source of feed for beef cattle when used at appropriate levels. Feedmills currently grind refuse screenings to reduce bulk, then add back grains, oilseeds or high quality screenings to improve feed value and consistency.

Canola screenings are a particularly efficient alternative to barley silage. Using an appropriate level is the key.

The opportunity. A recent study shows that canola screenings are a particularly efficient alternative to barley silage and/or barley grain in finishing rations, or as a replacement for oats in creepfeeding rations.

As creepfeed, intake of screenings was 3-5 pounds per day, and resulted in weight gains similar to what would be expected when feeding oats to suckling calves. Performance of feedlot cattle fed 85 percent barley grain and 15 percent barley silage was similar to those fed 75 percent barley grain and 25 percent canola screenings.

The system. Using an appropriate level is the key to efficient use. When screenings in the diet were pushed beyond 50 percent, feed efficiency and animal growth levels dropped. Also, cattle fed high levels of screenings - 75 to 100 percent - developed bloat problems believed to be caused by the shattering and breakup of pellets. Increases in digestive upsets were attributed to a lack of long fiber, which is needed to stimulate rumination and saliva production. Reducing the breakup of screenings and including low levels of roughage are necessary for an efficient system.

Results show that on a dry matter basis, a diet of straw or silage at 4 to 6 percent, screenings at 20 to 30 percent, and the rest as barley grain can be a viable feeding program for finishing cattle.

For more information contact Dr. John Popp, (403) 529-3616.

Tapping the potential of beef niche markets

More than 40 percent of Canadian beef produced is exported, and currently, most of that goes to the United States. But growing markets in the Pacific Rim countries are offering new possibilities. Since consumers in these countries prefer highly-marbled beef and are willing to pay top dollar to get it, scientists at the Lethbridge Research Centre are researching genetic options to capture that potential.

Currently, less than two percent of carcasses produced in North America grade "Prime" which is equivalent to having "slightly abundant marbling". However, cattle have to be fed for extended lengths of time on expensive feed for the carcasses to hit that carcass grade. Genetics offer an alternative.

A genetic alternative. One ongoing program targets better marbling by taking advantage of genetics in Japanese Wagyu, a cattle breed known for its marbling characteristics.

Japanese Wagyu marble substantially, but they are small frame animals with low birth weights. Typically in Japan, Wagyu cattle take 36 months to finish because they are fed with crop residues and are backgrounded for a long duration to maximize meat yield. Experiments are underway to determine whether any combination of North American and Wagyu genetics can provide the basis for cattle with both the faster growth rate and the higher marbling potential.

In one study, Angus or 50 percent Wagyu dams were bred Wagyu to obtain either 50 or 75 percent Wagyu cattle. These cattle were backgrounded and finished with diets commonly used in Canadian feedlots and the growth performance, carcass characteristics and meat quality were compared to those of crossbred cattle commonly used in Canadian feedlots.

Better marbling. When the marbling score was determined, 60 of 65 carcasses from Wagyu crossbred cattle graded Canada AAA, and contained more than a "small" amount of "intramuscular fat" or marbling. Twenty of these carcasses graded Canada Prime - AAAA, an equivalent to Prime in the USA. By contrast, only two of the six continental crossbred cattle graded Canada AAA. The fat content reflects the marbling grade awarded to the meat.

Consumers in Pacific Rim countries are willing to pay top dollar for highly-marbled beef. Genetics could open the market for Canadian producers.

The best of both worlds. Results show that Wagyu genetic influence makes for better marbling, but poor feed efficiency and higher slaughter ages causes a decline in production efficiency. The 50 percent Wagyu cattle offer a good balance between these characteristics, taking the marbling of Japanese cattle and the efficiency of North American breeds. Results indicate that steers with 50 percent Wagyu genetics can be finished with barley based diets to produce an acceptable carcass within 17 months.

For a Research Report contact Dr. Priya Mir, (403) 317-2228.

How to cut nitrogen losses in beef and dairy cattle

Scientists believe a new precision approach to protein feeding can substantially cut nitrogen losses in beef and dairy cattle. The research potential extends beyond the farm base. By increasing cattle nitrogen retention, not only is manure nitrogen lowered for better balanced fertilizer, the potential for volatile urea releases to the atmosphere is dramatically lowered.

The issue. Too much nitrogen is lost as manure because of inefficient ruminant digestion. This can lead to waste problems. Researchers believe more nitrogen can be retained by the animal using feeding systems that optimize digestion.

Ruminants have a unique ability to obtain energy from low quality feeds that would otherwise be indigestible. But this same rumen environment is very inefficient for converting feed protein into meat or milk protein. Though feed protein contains approximately 16 percent nitrogen, less than 20 percent of that is retained in meat or tissue protein. Dairy cattle typically capture 25 to 30 percent of feed nitrogen as milk protein. However, this can often drop to 15 percent with silage-based diets.

Researchers believe more nitrogen can be retained by the cattle using feeding systems that optimize digestion.

While manure can be an excellent source of nitrogen fertilizer, it can be a significant contributor to water pollution in areas of intensive livestock agriculture. Most of the nitrogen excreted by cattle is in the form of urea which can be rapidly converted to ammonia and contribute to global climate change. Up to 50 percent of manure nitrogen is lost to the atmosphere.

A new approach. To date, most research has concentrated on increasing the undegradable intake protein content of feed to meet the animal's protein requirement. This maximizes production but often results in over-feeding protein and increased nitrogen excretion.

Scientists at the Lethbridge Research Centre have taken a more balanced approach. The first step is to maximize rumen microbial protein synthesis. This can be accomplished by linking carbohydrate fermentability and effective fiber with protein availability in the rumen. This stabilizes the rumen environment and decreases total protein requirements. Certain naturally occurring feed additives can be used to further stimulate overall bacterial protein production. These compounds can increase growth rate of growing cattle by 12 to 15 percent on both high-forage and high-concentrate diets.

The second step is to meet additional protein requirements using a well balanced protein supplement to meet the specific amino acid needs of cattle. By feeding dairy cows a correct balance of amino acids, researchers have been able to increase milk production while increasing nitrogen retention from 28 to 36 percent of total feed nitrogen.

By increasing nitrogen retention in cattle, livestock operators can not only reduce total nitrogen in manure, but also dramatically reduce the proportion of potentially volatile urea. This also improves the ratio of nitrogen to other nutrients in manure, making it a better balanced source of fertilizer.

For a *Research Report* contact Dr. Lyle Rode, (403) 317-2232.

Rethinking production systems for feedlot cattle

Feedlots based on high grain diets could be under-utilizing forages, say researchers. Studies at the Lethbridge Research Centre show it may be time to rethink production systems to take better advantage of the high-fiber feed component.

Supplements not enough. When grain prices are low, some producers believe cattle can be profitably fed diets containing only grain and supplemental protein, minerals and vitamins. But research shows that even under these conditions, some forage is necessary for optimum performance. The essential characteristic of forages is their high fiber which stimulates rumination and lowers the risk of problems such as off-feed, founder, rumenitis, liver abscesses and bloat. Fiber is a characteristic supplements can't replace.

High-quality forages under-utilized. The potential increase in animal productivity is great if the digestibility of forages is high. For example, forages that have 70 percent digestibility are about 65 to 75 percent as efficient as grain for maintenance and weight gain.

Production increases are possible with only a modest increase in digestibility. Studies show that increasing the digestibility from 55 to 60 percent can cause a three-fold increase in weight gains from 0.14 to 0.42 kg per day, and an increase from 60 to 65 percent leads to a weight gain jump from 0.42 to 0.87 kg per day.

Additives may unlock potential. Even though some feedstuff contains up to 90 percent potentially energy-yielding nutrients, a significant proportion of those nutrients are not utilized. Work is underway at the Lethbridge Research Centre to extract that potential energy with enzymes and other feed additives that increase digestibility.

Innovative methods for boosting digestibility. The researchers are working to improve production efficiency by using high-quality forage in backgrounding and finishing beef cattle feeding systems. To do so, they're developing innovative feed production management methods that fit into current systems.

One source working particularly well is silage from intercropped barley and annual ryegrass. Studies show that feeding the intercropped silage to growing or finishing steers - with minimum amounts of barley grain - meets nutritional requirements for optimal performance from the animal. The intercrop also yields over 50 percent more than barley for silage under the same growing conditions.

In a series of recent experiments at the Centre, steers performed significantly better on barley/annual ryegrass silage than on barley silage. Dry matter intake, average daily gain, feed conversion efficiency and carcass weights all improved for backgrounded steers. The strong showing makes barley/annual ryegrass silage a valuable alternative for efficient beef production in barley based diets.

The potential increase in animal productivity is great if the digestibility of forages is high.

The study also serves as a basis for determining the minimum amount of grain needed to produce acceptable beef. Scientists believe forages will also play an important role in reducing age at slaughter and producing a uniform, predictable beef carcass for consumers.

For a *Research Report* contact Dr. Zahir Mir, (403) 317-2229.

A network of excellence

The National Beef Science Seminar is brought to you by the Lethbridge Research Centre, part of Agriculture and Agri-Food Canada's Research Branch, a network of 18 linked centres from coast to coast with ties to global research networks. As the Centre with a national mandate for beef production efficiency, the Lethbridge Research Centre is linked to beef industry organizations across the country.

Research partners

Scientists in the Livestock Sciences Section work closely with colleagues in sister sections at Lethbridge: forage and bio-control research is done in conjunction with the Crop Sciences Section; waste nutrient management and range management work is a cooperative effort with the Land Resource Sciences Section and the Kamloops Range Research Ranch in British Columbia.

Livestock Sciences also works directly with the Lacombe Research Centre, headquarters for Canada's meat research program, the Brandon Research Centre, which has a program on female livestock reproductive physiology, and with other Agriculture and Agri-Food Canada centres.

Here are other major partners:

The Canada/Alberta Livestock Research Trust Inc. This organization works with producer groups to support beef research. All livestock used at the Lethbridge Research Centre is supplied by the Canada/Alberta Livestock Research Trust.

Alberta Agriculture, Food, and Rural Development. Agriculture and Agri-Food Canada Centres work with their Alberta counterparts on a number of livestock and forage projects.

Universities. Lethbridge livestock scientists have research partnerships and teaching relationships with a number of universities throughout Canada.

Emerging partnerships. The research network is expanding and developing, and the Lethbridge Research Centre is positioned to work with new organizations such as the Western Beef Development Centre.

Tapping Canada's potential

Canada has strong growth potential in world-wide agriculture. The Lethbridge Research Centre is part of a cooperative research effort to harness that opportunity. With strategic partnerships toward a common goal, organizations, companies and governments are working to build Canada's beef business.

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